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Nina Aguillon - Barotropic/baroclinic splitting in ocean models

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This numerical strategy is commonly used in the ocean model community to reduce the computationnal cost. This model are 3 dimensional and frequently run with over 40 layers along the vertical. In a monolothic code the timestep is constrained by the speed of the gravity waves. In the barotropic/baroclinic splitting, the surface waves and the mean horizontal velocities are treated in a 2D manner, which makes this severe CFL acceptable. This barotropic part very much looks like a classical one layer shallow water model. The remaining adjustements contain exchanges between the vertical layers and the 3D advection of the tracers. It is much more costly but has a large material time step. In this talk we present this strategy in the framework of multilayer shallow water model with terrain following coordinates and detail the operator splitting. We present several nice properties of both the barotropic and the baroclinic parts. Numerical results based on a 3D code on Cartesian grid will illustrate how state-to-art strategies can be re-employed in the barotropic part, such as the perservation of the geostrophic equilibrium. This is a joint work with Sophie Hörnschemeyer (RWTH Aachen) and Jacques Sainte-Marie (INRIA/LJLL).